CLAIMS

What is claimed is:

1. A method for etching a trench to a trench depth in a dielectric layer over a substrate, comprising:

applying an ARC over the dielectric layer;

forming a photoresist mask on the ARC, wherein the photoresist mask has a thickness;

etching through the ARC; and

etching a trench into the dielectric layer with a dielectric to photoresist etch selectivity between 1:1 and 2:1.

2. The method, as recited in claim 1, wherein the forming the photoresist mask forms the photoresist mask to a thickness of between about 2000 Å and 4000 Å.

3. The method, as recited in claim 2, wherein the forming the photoresist mask forms the photoresist mask of a 193 nm or newer generation photoresist.

4. The method, as recited in claim 2, wherein the photoresist mask is sensitive to aggressive etch chemistries with respect to line edge roughness control.

5. The method, as recited in claim 2, further comprising:

placing the substrate into an etch chamber with an opposing electrode placed opposite the substrate; and

heating the opposing electrode so that the opposing electrode reaches a temperature of at least 140° C during the etching the trench into the dielectric layer.

6. The method, as recited in claim 2, wherein during the etching the trench the chamber pressure is maintained between about 60 mTorr and 400 mTorr.

7. The method, as recited in claim 2, wherein during the etching the trench a high frequency power source provides between 500 W and 2000 W.

8. The method, as recited in claim 2, wherein during the etching the trench a bias power source provides between 0 W and 1000 W.

9. The method, as recited in claim 2, wherein the etching the trench comprises providing an etchant gas selected from the group of CF_4, C_2F_6, NF_3, and SF_6.

10. The method, as recited in claim 9, wherein the etchant gas has less than 5% heavy polymer forming etchant gases.

11. A semiconductor device formed by the method according to claim 1.

12. A method for etching a trench to a trench depth in a dielectric layer over a substrate, comprising:

applying an ARC on the dielectric layer;

forming a sensitive photoresist mask on the ARC, with a thickness between about 2000 Å and 4000 Å;

etching through the ARC; and

etching a trench into the dielectric layer with a clean etch.

13. The method, as recited in claim 12, wherein the etch selectivity of dielectric to photoresist is between 1:1 and 2:1.

14. An apparatus for etching a feature in a dielectric layer , comprising:

a plasma processing chamber, comprising:

a chamber wall forming a plasma processing chamber enclosure;

a substrate support for supporting a substrate within the plasma processing chamber enclosure;

a pressure regulator for regulating the pressure in the plasma processing chamber enclosure;

an electrode placed opposite from and spaced apart from the substrate support;

a heater connected to the electrode for heating the electrode;

a gas inlet for providing gas into the plasma processing chamber enclosure; and

a gas outlet for exhausting gas from the plasma processing chamber enclosure;

a gas source in fluid connection with the gas inlet,

a controller controllably connected to at least one of the gas source the electrode, the heater, the pressure regulator, the gas inlet, and the gas outlet.

15. The apparatus, as recited in claim 14, wherein the controller comprises:

at least one processor; and

computer readable media, comprising:

computer readable code for providing an etch plasma for etching a feature into a dielectric layer; and

computer readable code for heating the electrode during etching so that the electrode reaches a temperature of at least 70° C.

16. The apparatus, as recited in claim 14, wherein the computer readable media, further comprises computer readable code for maintaining the pressure between 60 mTorr and 400 mTorr.

17. The apparatus, as recited in claim 14, wherein computer readable code for

providing an etch plasma for etching a feature into the dielectric layer comprises computer readable code for provide a high frequency power between 500 W and 2000 W.

18. The apparatus, as recited in claim 14, wherein computer readable code for heating the electrode during etching heats the electrode so that the electrode reaches a temperature of at least 90° C.

19. The apparatus, as recited in claim 14, wherein computer readable code for heating the electrode during etching heats the electrode so that the electrode reaches a temperature of at least 140° C.